

Web Based Teaching (WBT) has to be seen as part of Knowledge Management (KM)  
H.Maurer , Graz University of Technology, Austria  
[hmaurer@iicm.edu](mailto:hmaurer@iicm.edu)  
<http://www.iicm.edu/maurer>

Abstract:

In this paper I will argue that mankind is just about to take one more big developmental step due to continued progress in information and communication technology. Current and further developments are making huge bodies of knowledge available to everyone, everywhere and whenever needed. This has deep implications for all of mankind, but particularly also for the whole teaching and learning process.

1. Humanity on the road to a collective organism.

The proverbial “cavemen” lived in small groups: different tribes were basically autonomous, i.e. independent of each other. Even a single person was able to survive at the then usual standard of living for years without outside help if necessary. However, slowly more and more interaction between different population groups developed, starting with trade between neighboring tribes and turning into long distance trade of growing proportions. As a by-product different parts of the world became increasingly dependent on each other. With urbanization, industrialization and Taylorism the web of mutual dependence started to be incredibly dense: nobody in our Western civilization can survive without activities of many others anymore, at least not at the standard of living we today appreciate. In a way, individual persons have turned into a collective organism, into a new kind of “animal”: mankind. We as persons resemble cells in animals, or ants in an anthill, or cogwheels in big machinery, much more than we resemble independent, autonomous individuals. When we will sit together at lunch, we will sit in rooms built by persons from numerous professions: on furniture fabricated by some other sector of our industry, eating food coming from a huge agricultural complex; we will eat with tools such as glasses, plates or spoons yet originating in an other part of our society...and all of us belong to still a completely different type of profession.

What is true for physical things like food or furniture just mentioned is equally true for knowledge. Once it only existed in isolated brains of persons who may have communicated it to their children or pupils, more often by showing rather than what we would call teaching. Yet, over time knowledge became a more widely available commodity: by archiving it in books, by introducing schools and universities, by communication between a community of scholars. Consider how even just a few hundred years ago knowledge was “fragmented”, large libraries rare, the exchange of knowledge even between giants of science like Newton and Leibnitz by means of mail slow and cumbersome. However, we are now already in the process of leaving large and easy accessible scientific libraries of books behind, in favor of materials available over some kind of communication network, the World Wide Web (WWW), its successors or variants. This allows not just easy access to huge bodies of information but also impromptu discussions, criticism and comments: individual pockets of wisdom are merging into one large pool, individuals not just being networked for their physical needs but also their knowledge needs

This new animal mankind will have, as it is sometimes said, as blood the transportation systems of our world, as muscles the energy networks spanning all continents, as nerves the glass- fibre or wireless information channels, and as brain a mixture of human brains and huge data bases.

## 2. We have seen nothing yet

When we look at the largest (and at this point also the most chaotic library) the world has ever had, WWW, it is clearly starting to have some impact on many areas of life. There is a growing amount of information on just about any topic available, a growing number of transactions (from booking a flight to ordering a book) are possible, and communication between physically arbitrarily far apart persons is avalanching.

Before we discuss what this means for education as one application area it has to be clearly understood that what we see now is just the “tip of the iceberg”, the real changes and challenges are still before us. It is worthwhile to list some of them:

- The number of books and particularly journals on the WWW will increase dramatically
- The number of learning, teaching and training material on the WWW is going to multiply
- However, despite such growth it will become easier to find reliable information in the field desired due to three facts: (a) “information portals” (sometimes now also called vertical search engines), (b) “meta- information” and “grades” that will be attached to documents to allow more specific searches than is possible today, and (c) “user- profiles” that will assure that persons receive ( automatically and in time intervals they decide on) information on topics of their interest.
- Most of all, the WWW is going to turn increasingly from an information medium to a communication medium; this change will take many forms. Email is going to further explode but will slowly be integrated into knowledge- pools, discussion “forums” or “bulletin boards” will gain more popularity, expert online advice will be increasingly available, just to mention three of the many variants visible on the horizon.
- Knowledge management (KM) now in its infancy will gain much weight in the decade ahead of us. The idea comes from the frustrated statement of a director of some organizations that once said: “If our employees just knew what our employees know, we would be a much better organization”. I believe that anyone in charge of a substantial group of persons will concur that it would be great to get (at least part of) the knowledge of persons in that group into a computer system so that everyone can profit from it: this is what KM is all about.
- In connection with KM there is also my vision of “active documents”. The idea is this: whenever you see a document in WWW (or in your internal database) you can ask (e.g. type) an arbitrary question and the document (!) gives you immediately the desired answer. Sounds like science fiction? Well, it is not really. A good approximation can and has already been implemented by my group in

Graz. The basic idea is that when documents are available to e.g. 100.000 users than after the first 1.000 users have seen them, asked questions and the questions have been answered by experts, the other 99.000 users are very likely to ask similar question. The KM system remembers all questions asked and their answers. When someone else types a question the system “only” has to decide whether a semantically equivalent question has been already asked before, and if so, the system can give the answer without expert consultation.

- However, the biggest and most dramatic change will come from the fact that PCs and Laptops and such will fade in the background, and will be replaced by very small yet powerful devices that will act as computers that are hooked (wireless) into the WWW or its successor. Such “omnipresent computers” (let me call them OCs) will be available within the next 5- 8 years and will be a necessary part of the life of everyone: all persons will always carry such an OC with them. (I am always referring to our Western world, not the whole world). It is the OC and the successor of the WWW that is going to shake the fundamentals of many of our cherished and important activities, including communication and education.

### 3. The Omnipresent Computer (OC)

The Omnipresent Computer (OC) will be a cellular (mobile) phone with high communication rate. Just remember the (in)famous UMTS auction that has recently taken place in Germany to be able to introduce wireless telephony with higher bandwidth suitable for transmitting pictures, movies, etc. The OC will have a variety of standard functions that come with it, and some of the more obvious are listed below:

- It has an integrated camera that shoots both still pictures and videos. However, it is not just your digital photo or video camera; rather, due to its zoom function it can act as high power telescope or as low-power microscope; since it is able to work in the infrared spectrum it produces pictures both at night or in dense fog, and, yes, of course it acts as video phone. Make no mistake: the attraction of a video phone is not just that you can see the person you are talking to but you can show to that person what is going on around you: a view of your current vantage point in Graz, or a part of the movie you are just watching, or your children under the Xmas tree when you are calling your parents on Xmas day, etc.
- It is a full-fledged PC. So whatever you do today with your PC, you can do with the OC. And of course you can work with the WWW. “Work”, because you may not just want to surf around, you may want to send some mail, participate in a discussion, ask someone for an opinion or perform some transaction.
- The OC will have a built-in global positioning system. Whether this is satellite based or will use the grid-points of the wireless communication system to determine the current position is anyone's guess. However, it will not only allow you to locate exactly where you are on a map or consult the pages of a relevant guide book, but is likely to offer much more: sensors that determine the direction the person is looking in will allow to explain exactly what you see right now; speed sensors may help you to answer questions such as “how long is it still going to take me to reach the restaurant where I booked my table”; road maps will turn

into “backseat drivers”, i.e. your OC will tell you exactly when to turn at some junction, etc. And maps will be dynamic: when it is very hot lakes and beaches will be highlighted, as will shops selling umbrellas when rain is impending. And the right kind of food place will be shown to you depending on the time of the day, your location, the direction and speed of your movement.

- The OC will also be your electronic wallet. Securely and anonymously you will be able to pay both in the real world (i.e. shops) and the virtual world of WWW or other electronic shopping malls. Sooner or later, cash, credit cards and such will be as unknown as means to pay as gold coins are today.
- The OC will have both speech input and speech output; this will be convenient in many ways. It will also mean that it will act as your personal translator. When you use English/ German, you will talk into your OC in English and it will generate a fairly good translation into German for your counterpart who feels more comfortable in this language.
- Of course the OC will be a portable radio, a TV and the equivalent of a CD player. CDs will be by then replaced by other devices (like MP3 files stored on the OC), TV will have changed (when you want to watch a movie you just select one from a data-base and play it), and the radio will also have continued to evolve in what it offers: the same station different types of audio depending on your personal profile. The stations may not transmit to you like today, but via the WWW which you happen to receive maybe wireless! Clearly, you will have access to all information on the WWW, but you may also carry a selection of electronic dictionaries and books directly with you on the OC without needing the WWW.

You want to buy such an OC? Ok, just wait five years or so. But don't be disappointed if the first OCs do not have all the functions described; they will have enough surprises that have not been mentioned! Also, don't be surprised that the OC might not be much larger than your wallet, that some version may come as wristwatch, and some may be small enough to fit into some boy- cavity. How about instead of a porcelain tooth filling?

It is obvious to ask: How is it possible that such a universal device can be as small as described? Even if one accepts that computer chips will get very small and will require only little power (that may come from a re-useable battery or some way of generating energy from the human wearer), how can one use such a device if it “clearly” has no room for a display of good quality?

Well, the “clearly” is put in quotation marks on purpose: technology that allows displays to be folded, or rolled, or feels like a piece of paper but really is a display (the digital ink of MIT) is advancing. Most important, it is quite possible that we will not use screens in the future at all. Rather, to look a bit in the future, we might be wearing glasses that direct the audio output of the OC directly to the ear and the video via glas-fibre to the front, projecting the picture through the pupil directly on our retina: projecting two different pictures for the two eyes the image can be three-dimensional and can act as “overlay” over what you see through the glasses. Thus, when you look at something, your OC (if you have chosen this option) gives you as overlay a description of what you are seeing, potentially with all kinds of additional

information. Cute for a tourist who gets all the details he wants as he looks at a building, maybe more than cute for learning purposes!

Thus, receiving visual and audio information from the OC will be easy. At this point it is not clear which input device will win-out: keyboards that consist of cloth and are part of your jacket, voice activated input, or other input device that are currently experimented with. I will show a few pictures in my talk. I cannot include them in the printed version for copyright- reasons, but if you check with any of the WWW search engines under +computers +wearables you are in for a surprise if you have not seen such gadgets before.

There are other issues. How are the various parts I have described networked, what additional sensors and devices might be useful and available: for the purpose of this paper what counts is one fact: before the end of this decade information and communication tools will be omnipresent, will be used by everyone, and will be small enough that one may hardly notice them or that they are in use.

#### 4. What Does This All Mean for Education?

It needs little imagination to understand that such new technology will influence many of our habits, our life-style and our work. And this surely includes all aspects of education.

The very first question that comes into ones mind is: if all information or human knowledge is present everywhere at any time anyway, is learning still a necessity?

The answer - and some may breathe a sigh of relief - is "yes". Not only is it unclear how we can think within information in our brain, even the retrieval of information is a non-trivial matter, particularly since we are just starting to learn that remembering content is often easier than remembering the source (i.e. where we found the content).

Thus, learning will remain, but will be quite different from what we now often see on the WWW:

When we look at the WWW today we find thousands of efforts to use it for educational purposes. However, most attempts are limited to a sequence of HTML pages, sometimes including interactive features like quizzes or simulations, and often a smattering of communicational features based on email.

From what has been said above it should be clear that WBT or as it is now often called "e-Learning" can and must be much more than this. It must include powerful collaborative features, use the WWW and other sources as omnipresent background library, and must be based on the assumption that different persons have different knowledge backgrounds and different learning styles.

Thus, an ideal "e-Learning environment" must include at least partial solutions of the following issues:

- Educational material comes in small modules that have meta-data associated with them to be able to find what one wants. The modules must be related by a "dependency network" to allow individualised instruction.
- Using the dependency network mentioned it is possible to customise material for each user as follows: when a module is selected the system determines all modules that are necessary to understand the one chosen: by asking questions the system determines which of those "auxiliary" modules have to be presented first before the actual module of interest can be used.
- In ideal environments, the system should not only customise the knowledge level as explained above but also the learning style (more audio, more video, more haptic actions, etc.) most suitable for the current learner.
- As persons work through the material they must be able to add material and links for their own benefit, or for the benefit of later users. I.e., the system must provide a powerful "annotation mechanism" including authorisation for individuals and groups.
- Users must be able at any point to consult background libraries, be it on the server they are currently working with or somewhere else on the Internet or the Intranet; and they must be able to incorporate such information found for themselves and for others. Note that this is just one of the features that assures that the material gets richer (more knowledge is generated) as more persons use the system.
- Users must be able at any time to chat with others online, to work with discussion forums, to use collaboration spaces and to ask experts. Note again that the questions and the answers given will enrich the educational material, turning documents into "active documents" as mentioned earlier.

Summarising, the traditional notion of "courseware" that is made available once and for all for users has to be replaced by the notion of a network of learners working with and enriching existing material, their isolation broken by the Web, their individual level of knowledge and style of learning respected by the system. Then and only then can e-Learning be successful and is an important component of knowledge management.

First attempts in this direction can be found in a number of systems. The GENTLE system (GEneral Networked Teaching and Learning Environment) at <http://www.gentle-wbt.com> is one of them. It is now available free of charge for universities and schools. It is marketed by the knowledge management company Hyperwave at <http://www.hyperwave.com>.

## 5. Summary

In this somewhat provocative paper I have tried to argue that powerful networked computers (OCs) will be omnipresent within a decade, and will influence all areas of education. I have tried to show that "WBT" or "e-Learning" should not be seen as an isolated phenomena but as part of knowledge management.

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